What is claimed is:

Independents. 1, 26, 51, 62

1. An arrangement for isolating a rotatory mechanical system for a vehicle while it is subjected to a testing process, the rotatory mechanical system being of the type having a rotatory input, the arrangement comprising:

a base;

an isolation support for supporting the mechanical drive system whereby the mechanical drive system is translatable rotatably with respect to said base;

a rotatory driver coupled resiliently to said base and to the rotatory input of the rotatory mechanical system for applying a torque to the rotatory mechanical system and thereby urging the rotatory mechanical system into substantially isolated rotation; and

an accelerometer coupled to the rotatory mechanical system for producing an accelerometer signal responsive to variation in the rate of angular displacement.

2. The arrangement of claim 1, wherein said isolation support is translatable in at least one plane of freedom with respect to said base in response to a rotatory energy supplied thereto by said rotatory driver.

3. The arrangement of claim 2, wherein said isolation support is translatable in plural planes of freedom with respect to said base in response to the rotatory energy supplied thereto by said rotatory driver.

4. The arrangement of claim 1, wherein there is further provided a further accelerometer coupled to the rotatory mechanical system for producing a further accelerometer signal responsive to variation in the rate of angular displacement.

5. The arrangement of claim 4, wherein said further accelerometer is disposed in diametrical opposition to said accelerometer.

6. The arrangement of claim 4, wherein there is further provided a summing arrangement for summing the accelerometer signal and the further accelerometer signal, whereby a constant effect is canceled.

7. The arrangement of claim 1, wherein there is provided a collar arrangement for supporting said accelerometer, said collar being arranged to be rotated synchronously with the rotatory mechanical system.

8. The arrangement of claim 1, wherein there is provided a signal analysis system for identifying in the accelerometer signal an operating characteristic of the rotatory mechanical system.

9. The arrangement of claim 8, wherein said signal analysis system identifies a torsional operating characteristic of the rotatory mechanical system.

10. The arrangement of claim 8, wherein said signal analysis system identifies a vibratory operating characteristic of the rotatory mechanical system in at least one plane of vibratory motion.

11. The arrangement of claim 8, wherein there is provided a wireless transmission system for propagating the accelerometer signal to said signal analysis system.

12. The arrangement of claim 11, wherein said wireless transmission system comprises an induction system.

13. The arrangement of claim 1, wherein there is provided a wireless power delivery system for delivering power to said accelerometer.

14. The arrangement of claim 13, wherein said wireless power delivery system comprises an induction system.

15. The arrangement of claim 8, wherein the operating characteristic of the rotatory mechanical system is determined in drive and coast operating modes of the rotatory mechanical system in response to a direction of torque of said rotatory driver.

16. The arrangement of claim 1, wherein the vehicle has a predeterminable vehicle resonant frequency, and a resonant frequency of said rotatory driver is significantly different from the vehicle resonant frequency.

17. The arrangement of claim 16, wherein the resonant frequency of said rotatory driver in combination with the resonance characteristics of said base and other components of said isolation support is significantly different from the vehicle resonant frequency.

18. The arrangement of claim 1, wherein the vehicle has a predeterminable vehicle resonant frequency characteristic, and a resonant frequency characteristic of said isolation support is configured to simulate the vehicle resonant frequency characteristic.

19. The arrangement of claim 18, wherein the vehicle has a predeterminable vehicle torsional resonant frequency characteristic, and a torsional resonant frequency characteristic of said isolation support is configured to simulate the vehicle torsional resonant frequency characteristic.

20. The arrangement of claim 1, wherein said isolation support comprises a resilient support element for supporting the rotatory mechanical system, said resilient support element having a resilience frequency characteristic that excludes a natural frequency of the rotatory mechanical system.

21. The arrangement of claim 20, wherein said resilience frequency characteristic of said resilient support element excludes a natural frequency of said rotatory driver.

22. The arrangement of claim 1, wherein there is further provided a rotatory load arrangement for applying a rotatory load to the rotatory mechanical system.

23. The arrangement of claim 22, wherein said rotatory load arrangement applies a controllable rotatory load thereto to simulate a plurality of vehicle operating conditions.

24. The arrangement of claim 23, wherein the vehicle operating conditions include gear drive and coast conditions.

25. The arrangement of claim 23, wherein the vehicle operating conditions include a gear float condition.

26. A method of testing a rotatory mechanical system of the type having an input, the method comprising the steps of:

installing the rotatory mechanical system on a mounting arrangement that resiliently permits rotatory motion of the rotatory mechanical system, and that has a resilient frequency characteristic that excludes all natural frequencies of the gear assembly;

applying a torque at the input of the rotatory mechanical system, whereby the rotatory mechanical system is rotatably operated; and

sensing a predetermined rotatory operating characteristic of the rotatory mechanical system.

27. The method of claim 26, wherein said step of sensing comprises the step of detecting torsional vibration issued by the rotatory mechanical system.

28. The method of claim 27, wherein there is further provided the step of detecting electromagnetic energy issued by the rotatory mechanical system.

29. The method of claim 28, wherein said step of detecting electromagnetic energy comprises the further step of directing a thermal energy sensor to monitor the temperature of a predetermined region of the rotatory mechanical system.

30. The method of claim 29, wherein said predetermined region is a region of a bearing of the rotatory mechanical system.

31. The method of claim 30, wherein there is provided the further step of monitoring a variation in temperature over time of the region of the bearing.

32. The method of claim 31, wherein there is provided the further step of determining a qualitative torsional characteristic of the bearing in response to said step of monitoring a variation in temperature over time of the region of the bearing.

33. The method of claim 28, wherein there is provided the further step of determining a qualitative characteristic of a lubricant in the rotatory mechanical system.

34. The method of claim 26, wherein said step of sensing comprises the step of detecting vibratory torsional displacement energy issued by the rotatory mechanical system.

35. The method of claim 34, wherein said step of detecting vibratory torsional displacement energy issued by the rotatory mechanical system comprises the further step of effecting communication between an accelerometer and the rotatory mechanical system.

36. The method of claim 26, wherein said step of sensing comprises the further step of monitoring wirelessly a first sensor that is responsive to the rate of change of angular velocity of the rotatory mechanical system.

37. The method of claim 36, wherein the drive mode of operation is in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the drive mode of operation includes a qualitative condition of a first surface of gear teeth of the rotatory mechanical system.

38. The method of claim 36, wherein the drive mode of operation is in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the drive mode of operation includes a qualitative condition of a profile of a gear of the rotatory mechanical system.

39. The method of claim 36, wherein said drive mode of operation is in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the drive mode of operation includes a qualitative condition of the eccentricity of a gear of the rotatory mechanical system.

40. The method of claim 36, wherein said drive mode of operation is in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the drive mode of operation includes a qualitative condition of the angular orientation of the gears of the rotatory mechanical system.

41. The method of claim 36, wherein said drive mode of operation is in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the drive mode of operation includes a qualitative condition of a plurality of moving components of the rotatory mechanical system.

42. The method of claim 36, wherein said step of sensing comprises the further step of monitoring wirelessly a second sensor that is responsive to the rate of change of angular velocity of the rotatory mechanical system.

43. The method of claim 42, wherein said step of monitoring is performed during a coast mode of operation in a first direction of operation.

44. The method of claim 42, wherein said step of monitoring is performed during a coast mode of operation in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the coast mode of operation includes a qualitative condition of a profile of a gear of the rotatory mechanical system.

45. The method of claim 42,wherein said step of monitoring is performed during a coast mode of operation in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the coast mode of operation includes a qualitative condition of the eccentricity of a gear of the rotatory mechanical system.

46. The method of claim 42, wherein said step of monitoring is performed during a coast mode of operation in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the coast mode of operation includes a qualitative condition of the angular orientation of the gears of the rotatory mechanical system.

47. The method of claim 42,wherein said step of monitoring is performed during a coast mode of operation in a first direction of operation, and the qualitative condition of the rotatory mechanical system in the coast mode of operation includes a qualitative condition of a plurality of moving components of the rotatory mechanical system.

48. The method of claim 42, wherein said step of monitoring is performed during drive and coast modes of operation over a period that is shorter than a cycle period of the input of the rotatory mechanical system.

49. The method of claim 42,wherein said step of monitoring is performed during drive and coast modes of operation over a period that is longer than a cycle period of the input of the rotatory mechanical system.

50. The method of claim 42, wherein the first and second sensors are disposed at respective locations that are diametrically distal from each other.

51. A method of signal analysis for processing information from a gear system under test, the method comprising the steps of:

driving the gear system under test by application of a rotatory input;

producing a first signal responsive to variation in the rate of the rotation of the gear system under test;

producing a second signal responsive to a noise produced by the gear system under test in response to said step of driving;

producing digital data responsive to a correlation between the first and second signals;

converting the digital data into corresponding frequency components;

subjecting the frequency components to analysis to determine a power spectrum density of the frequency components; and

subjecting the power spectrum density to harmonic analysis.

52. The method of claim 51, wherein there are provided the further steps of:

establishing predetermined harmonic criteria; and

determining whether the results of the analysis in said step of subjecting conforms to the predetermined harmonic criterial of said step of establishing.

53. The method of claim 51, wherein the first signal responsive to the variation in the rate of rotation of the gear system under test is responsive to the angular position of the gear system under test.

54. The method of claim 51, wherein there is provided the further step of producing a third signal responsive to vibratory motion of the gear system under test in at least on plane of freedom.

55. The method of claim 54, wherein the third signal is responsive to the variation in the rate of rotation of the gear system under test and to the angular position of the gear system under test.

56. The method of claim 51, wherein during said step of driving the gear system under test by application of a rotatory input there is provided the further step of supporting the gear system under test on a support arrangement that provides at least one plane of freedom of vibratory motion of the gear system under test.

57. The method of claim 56, wherein the support arrangement has a resonance characteristic that simulates that of a vehicle on which the gear system under test will be installed.

58. The method of claim 56, wherein the support arrangement has a resonance characteristic that is significantly different from that of a vehicle on which the gear system under test will be installed.

59. The method of claim 51, wherein there is further provided the step of applying a load to the gear system under test.

60. The method of claim 59, wherein there is further provided the step of controlling the loading applied to the gear system under test.

61. The method of claim 60, wherein said step of controlling the loading applied to the gear system under test is responsive to the second signal.

62. A method of signal analysis for processing information from a gear system under test for determining the presence of an anomaly therein, the method comprising the steps of:

driving the gear system under test by application of a rotatory input;

producing a first signal responsive to the rate of change of angular velocity of the gear system under test;

producing first digital data responsive to a first correlation between the first signal and time;

measuring peaks in said first digital data to determine whether the peaks exceeds a predetermined threshold magnitude; and

first subjecting those of the peaks that exceed the predetermined threshold magnitude to harmonic analysis.

63. The method of claim 62, wherein there is provided the further step of comparing the result of the harmonic analysis of said step of first subjecting against gear tooth harmonics to determine whether the peaks constitute an anomaly.

64. The method of claim 62, wherein there is provided the step of applying a load to the gear system under test.

65. The method of claim 64, wherein there is further provided the step of controlling the loading applied to the gear system under test.

66. The method of claim 63, wherein the anomaly is a bump or a nick on a tooth of the gear system under test.

67. The method of claim 62, wherein there are provided the further steps of:

producing a second signal responsive to a noise produced by the gear system under test in response to said step of driving;

producing a second digital data responsive to a second correlation between the second signal and time;

identifying peaks in said second digital data that are simultaneous with peaks in said first digital data;

measuring said simultaneous peaks in said second digital data to determine whether they exceed a second predetermined threshold magnitude; and

second subjecting those of the simultaneous peaks in said second digital data that exceed the second predetermined threshold magnitude to harmonic analysis.

68. The method of claim 67, wherein there is provided the further step of comparing the result of the harmonic analysis of said steps of first subjecting and second subjecting against gear tooth harmonics to determine whether the simultaneous peaks constitute an anomaly.